

Large-Scale Composting:

Getting in the Business - Day-to-Day Operations

If you are a landscaper, farmer, developer, local government or plan to be in the composting business, you may have to be registered or permitted by the S.C. Department of Health and Environmental Control (DHEC). This publication will help you prepare for the application process administered by DHEC. Requirements directly addressed in yard waste and other relevant regulations. **Some of the regulatory concerns are noted with an asterisk.**



Pictured is Clemson University's large-scale composting facility.

Composting Preparation

- ✿ **Feedstock selection.** Identify the organic materials to be mulched or composted. Woody yard materials and land-clearing debris may be composted with source separated vegetative materials such as produce trimmings, grass and manures. It is more difficult to manage the moisture and control odor in the composting process with materials high in nitrogen (such as the ones listed above), but unless there is an appropriate balance of high nitrogen materials with those high in carbon, the process will be slow and inefficient.
- ✿ **Feedstock preparation.** Process incoming material such as grass or other high nitrogen material within 48 hours.* Leaves and grass can be placed immediately in windrows in predetermined proportions with ground wood waste as the first step. Attention to incoming loads and segregating them immediately will save time and money as well as increase efficiency. Large diameter tree trunks must be stored separately if they will not be processed with the other yard and land-clearing debris. In all cases, 75 percent of incoming organic material must be processed within one year.*
- ✿ **Proper moisture, nutrient balance, porosity and oxygen** set the conditions for efficient composting:
 - 🔧 Set the initial porosity of the pile at about 45 to 60 percent; porosity is determined by the particle size of the feedstocks and the bulking agents.
 - 🔧 Reduce high carbon materials such as wood and land-clearing debris to one- to two-inch chips in preparation for composting;
 - 🔧 The best initial nutrient balance in the windrow is about 30 parts carbon (C) to one part nitrogen (N) as calculated by formula. An example from the field shows a 1 (dry sawdust) : 2 (raw manure) ratio by volume will be about the right C:N and moisture;
 - 🔧 The initial moisture content of the windrow should be in the range of 50 to 55 percent (see Squeeze Test on the back page); and
 - 🔧 The initial pH should be above 5.0 (ideal 6.5-8.0).

Continued inside

Compost Pile Management (active phase)

The Code of Federal Regulations, Part 503, outlines criteria to reduce disease-causing pathogens in biosolids. The Process to Further Reduce Pathogens (PFRP), has been adopted by the composting industry to apply to all other feedstocks, includes:

- Maintaining aerobic conditions;*
- Turning a minimum of five times in 15 days and maintaining a temperature of 131 degrees F (55 degrees C) for turned windrows; or
- Covering pile with six to 12 inches of insulating material (e.g., sawdust, cured compost or wood chips) and maintain a temperature of 131 degrees F (55 degrees C) for three consecutive days for aerated static windrows.

Other pile requirements include the following:

- 🌿 The height of the pile may vary depending on the equipment available for turning but should not exceed nine feet (eight to 8.5 feet ideal).
- 🌿 Moisture should be kept at about 45-60 percent throughout the composting process;
- 🌿 Pile porosity should be maintained above 35 percent;
- 🌿 Oxygen should be about 16 percent. The oxygen needs of the microorganisms are provided by convective aeration induced by the hot pile temperature and cooler surrounding ambient air and porosity restoration...by a
- 🌿 combination of coarse material and routine turning (Leege, "Training Course for Facility Operators");
- 🌿 Grade the site to prevent ponding.* The slope should be about two percent; and
- 🌿 Direction of windrows should be parallel to slope.* In a site drawing, identify the area to contain storm runoff such as pasture, cropland, infiltration area, holding pond or proposed method.*



A tractor turns a windrow at a large-scale composting facility.

Compost Pile Management (curing phase)

- 🕒 Retain or add bulking material to increase porosity or use mechanical ventilation to prevent odors;
- 🕒 Oxygen levels should be at least 16 percent, piles no higher than nine feet and moisture level 45 percent or higher. At this point, use only fresh water, not leachate, to remoisten.
- 🕒 Allow sufficient curing time to allow for compost maturity and sufficient stability for the anticipated market; and
- 🕒 Prevent bird and animal access to the material to avoid reintroduction of pathogens. For example cover the piles with tarps.



Large tarps cover windrows at the Georgetown County Composting Facility. They are used to control moisture and reduce the risk of contamination

Compost Management (screening and storage phase)

- If necessary, screen compost for inert and oversize material. Markets such as nurseries require a consistent product of uniform texture and particle size. High volume agricultural markets, can tolerate more variance but all compost should be free of bits of plastic and other inert material;
- Keep moisture greater than 35 percent (dust threshold); and
- Distribute finished compost within one year (beyond this time the material loses organic value).



Compost is screened at Georgetown County's composting facility.

Record Keeping

The following information should be kept in an operations log:

- Measurement of organic material (tons) received* daily;
- Source(s) of organic material (tons) received* daily;
- Daily temperature (degrees F), oxygen (percent), moisture (percent) and rainfall (inches). These records apply only to the active phase;
- Disposition of final product*;
- List of any complaints, including nature of complaint, date and time complaint was received, and the party registering the complaint; and
- An emergency preparedness plan for fire, leachate and other unplanned discharge(s). Include contact names and phone numbers.

WINDROW #1						
DATE	TEMPERATURE	OXYGEN %	MOISTURE %	RAINFALL	BULK DENSITY (lbs/yds ³)	FREE AIR SPACE
DAY 1						
DAY 2						
DAY 3						
DAY 4						
DAY 5						
DAY 6						
DAY 7						
DAY 8						
DAY 9						
DAY 10						

Adapt this chart to accommodate your composting facility. Other categories or charts may be needed to track the amount of materials accepted, processed and distributed. Track relevant data for materials everyday, from start to finish.

Mulch Facilities

The composting processing guidelines previously listed apply in limited ways to facilities that grind yard debris for immediate distribution (within 30 days).

- ✱ Reduce wood waste, yard debris, land-clearing debris and other high carbon material suitable for mulch to one- to two-inch chips. It is not necessary to monitor the temperature of chipped material distributed within 30 days.
- ✱ Large diameter tree trunks must be stored separately if they will not be processed with the other yard and land-clearing debris. But in all cases, 75 percent of all organic material must be processed within one year.*
- ✱ Composting guidelines outlined previously apply to materials that cannot be mulched, which include leaf debris and grass.

For more detailed information on current best management practices see the sources listed below:

- ✱ *"Training Course for Compost Facility Operators, Process Engineers, Managers and Regulators,"* by Philip B. Leege. Harrisburg, PA: The United States Composting Council, 2001. This was also the text used in several courses offered in South Carolina. E-mail: admin@compostingcouncil.org.
- ✱ *"On-Farm Composting Handbook,"* edited by Robert Rynk. Ithaca, NY: Northeast Regional Agricultural Engineering Service, 1992. E-mail: nraes@cornell.edu.
- ✱ *"Large-Scale Organic Materials Composting,"* by Rhonda Sherman. Raleigh, NC: North Carolina State University Cooperative Extension Service, 1999. E-mail: sherman@unity.ncsu.edu.



Office of Solid Waste
Reduction and Recycling
1-800-768-7348
www.scdhec.net/recycle

This technical information sheet is provided by DHEC's Office of Solid Waste Reduction and Recycling. The Office, which is non-regulatory, provides educational and technical assistance as well as grant funding to local governments, schools, colleges and universities.

Printed on Recycled Paper
OR-0333 4/02

The Squeeze Test

Field Measurement of Pile Moisture Percent:

Pile moisture percent can be estimated by squeezing a handful of material as follows:

- ✱ Reach into the pile and take a handful of material.
- ✱ Squeeze the handful of material firmly.
- ✱ Release your grip and inspect the material you squeezed and your hand.

Interpretation of Results:

- ✱ If the material you squeezed is crumbly and doesn't stick together, and your hand is dry, the material is about 40 percent moisture or less.
- ✱ If the material you squeezed sticks together, and your hand is moist, the material is around 50 percent moisture.
- ✱ If the material you squeezed sticks together and drips, and your hand is wet and dripping, the material is around 60 percent moisture or more.

With practice you can distinguish 55 percent moisture, from 50 percent and 60 percent moisture. Researchers report that the ideal pile moisture should range from 52-58 percent. Gardening professionals report that around 50 percent is the ideal moisture of soils for planting and growing.

